

# The impact of transport infrastructure on economic growth-- Taking the Zhujiang - Xijiang Economic Belt as an example

WeiGuo Ma<sup>1</sup>

<sup>1</sup>Wuhan University of Technology, School of Management Wuhan, China

**Abstract—** In recent years, with the continuous acceleration of urbanization construction, the city-centered metropolitan area has become an important factor of regional economic development. Based on the relationship between transportation infrastructure and economic growth, the Moran Index is calculated from the panel data of 11 cities in the Zhujiang- Xijiang Economic Belt from 2010 to 2017 to analyze the spatial correlation between transportation infrastructure and economy, and the results show that there is spatial autocorrelation between the two. This paper studies the spatial Dubin model of transportation infrastructure and economic growth, and the results show that transportation infrastructure has spatial spillover effect on economic growth, and economic growth has spatial spillover effect itself. On this basis, policy suggestions for regional development are put forward.

## 1 INTRODUCTION

With the rapid development of social economy, regional economic competition has become the main trend in economic development, and transportation infrastructure is an important driving force to integrate regional resources and promote economic development [1]. In February 2019, the State Council issued the Outline of the Development Plan for the Guangdong-Hong Kong-Macao Greater Bay Area, with the focus on instructing the Zhujiang-Xijiang Economic Belt to be the key to development, which accelerates the construction of Guangdong-Guangxi connectivity transportation infrastructure, and build a convenient and comprehensive transportation network system. The transportation infrastructure represented by Guangfo Subway not only optimizes the inter-city resource flow, but also promotes the regional integrated development based on the Zhujiang - Xijiang Economic Belt basin. Existing studies believe that the economic growth model driven by transportation infrastructure has become an important carrier of regional economic cooperation development. However, the research objects of regions are mostly provinces, ignoring the differences between cities, and the research results may lack guidance for urban development planning. Therefore, to research the influence of transportation infrastructure on economic growth in the Zhujiang - Xijiang Economic Belt will provide a reliable basis for urban development.

In empirical research of transportation infrastructure for economic growth, using time series data from 1952 to 2006 such as Chuanfeng Han causality in transportation infrastructure and economic growth, the influence degree was studied. Results show that the transport infrastructure

has significant promoting effect on economic growth, and highway's contribution rate of economic growth significantly greater than the railway transportation infrastructure [2]. However, the impact of transportation infrastructure on regional economic growth may be overestimated due to the lack of spatial spillover effect. Based on the provincial panel data from 1990 to 2010, Xiaodong Wang studied the impact of transportation infrastructure on economic growth through Feder model, and the results showed that transportation infrastructure produced positive spillover effect on economic growth [3]. Zhang Xueliang empirically analyzed the spatial spillover effect of transportation infrastructure by using the research method of 1993-2009 Inter-provincial data and spatial econometrics in China. The results showed that the effect of non-local transportation infrastructure on local economic growth was mainly positive spatial spillover effect, but there was also evidence of negative spatial spillover [4]. Zhongmin Li based on the new economic growth and new economic geography Angle, considering the spatial spillover effect of transport infrastructure, multidimensional factors of effect on economic growth, the empirical analysis results show that the new economic growth factors on the significant positive role in promoting regional economic growth, new economic geography variables is an important factor of economic growth [5].

Among the domestic literatures that can be consulted now, most of the researches on transportation infrastructure focus on a higher level, and few take cities as research objects. This paper takes the Zhujiang - Xijiang Economic Belt as the empirical analysis target, covers the spatial spillover effect of transportation infrastructure, and then studies the impact of transportation infrastructure on economic growth.

## 2 MODEL AND DATA PROCESSING

### 2.1 Spatial autocorrelation test

By calculating "Moran's Index", this paper determines whether the transportation infrastructure and economy of the Zhuhai-Xijiang Economic Belt have spatial correlation, that is, whether the degree of regional agglomeration is opposite or the same. If there is spatial autocorrelation, the influence of foreign factors on local economy needs to be considered.

$$I = \frac{\sum_{i=1}^n \sum_{j=1}^n w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{S^2 \sum_{i=1}^n \sum_{j=1}^n w_{ij}} \quad (1)$$

In the equation: it is the (i, j) element in the k-nearest matrix based on the distance relation. The general range of Moran index value is between (-1, 1). Moran's I >0 indicates that there is a positive spatial correlation, and the value is greater, the more obvious the spatial correlation is. Moran's I <0 indicates that there is a negative spatial correlation, and the greater the value is, the greater the spatial difference is. Moran's I = 0, and the space is random.

### 2.2 Spatial econometric model

If the Moran index is not zero, it should be considered that foreign factors will have an impact on the local economy, and the spatial measurement method is chosen to study the impact of transportation infrastructure on economic growth. In this paper, the spatial Durbin model (SDM) is used to study the impact of transportation infrastructure on economic growth and the spatial spillover effect of economic growth itself. After the test, the spatial Durbin model with fixed effects was selected and substituted into the model for regression analysis.

$$\ln gdp_{it} = \alpha_0 + \alpha_1 W_i \ln gdp_{it} + \alpha_2 W_i \ln trcap_{it} + \alpha_3 \ln trcap + \alpha_4 \ln road + \alpha_5 \ln labor + \alpha_6 \ln ind + \alpha_7 \ln gov + \mu_{it} \quad (2)$$

Where: GDP is the variable representing the urban economy; Represents different space weight matrix; Trcap is a variable representing transportation infrastructure; Road is a variable indicating the degree of development of traffic infrastructure; Labor is a variable representing the number of employees; Ind is the variable of the proportion of urban tertiary industry; Gov is a variable that represents local government spending.

### 2.3 Variable selection and data sources

Transport infrastructure together with degree of development, employment, proportion of tertiary industry and government general public expenditure as explanatory variables, urban economic status as explained variables. The proxy variable for the state of the city economy is the nominal GDP of each city. The number of employees is the number of employees in each city in each year. The proxy variable of the degree of

development of transportation infrastructure is the road area (Road, km) of each city. The proxy variable of the proportion of urban tertiary industry is the ratio of the added value of each city's tertiary industry to nominal GDP (Ind, %). The proxy variable of local government expenditure is the ratio of general public expenditure to GDP (Gov, %). Transport infrastructure proxy variable is the capital stock of transportation, warehousing, postal and telecommunication services (Trcap, \$one hundred million). The calculation method of the capital stock is using the perpetual inventory method with 2011 as the base, calculation base fixed assets the capital stock of urban transportation, postal and telecommunication services. Then use base and transportation and postal and telecommunication services in each of the calculation of investment in fixed assets in each of the capital [6]. The data in this paper are from China Statistical Yearbook from 2010 to 2017, statistical yearbooks of cities and statistical Bulletins of national economic and social Development.

**TABLE I.** DESCRIPTIVE STATISTICS OF EACH VARIABLE

Variable	Mean	Std.Dev	Min	Max	Obs
gdp	3281.625	4820.515	480.7	21503.15	77
trcap	477.9525	605.7828	29.4026	2623.477	77
road	2195.674	3040.539	86	13012.82	77
labor	57.420	91.5324	1.39	329.17	77
ind	0.420	0.1063	0.2842	0.7094	77
gov	0.0696	0.0242	0.0167	0.1127	77

## 3 MODEL RESULTS AND ANALYSIS

### 3.1 Spatial autocorrelation test results and analysis

**TABLE II.** MORAN'S I AND P VALUES OF ECONOMIC GROWTH IN THE ZHUJIANG - XIJIANG ECONOMIC BELT

Year	Wk	
	Moran's I	p
2011	0.698	0.015
2012	0.679	0.014
2013	0.637	0.014
2014	0.620	0.015
2015	0.317	0.016
2016	0.615	0.014
2017	0.610	0.012

**TABLE III.** MORAN'S I AND P VALUES OF ECONOMIC GROWTH IN THE ZHUJIANG - XIJIANG ECONOMIC BELT

Year	Wk	
	Moran's I	p
2011	0.685	0.020
2012	0.678	0.022
2013	0.677	0.023
2014	0.671	0.023

2015	0.659	0.024
2016	0.647	0.024
2017	0.640	0.028

The results show that the economic growth of the Zhujiang - Xijiang Economic Belt exists spatial autocorrelation with the transportation infrastructure, which is mainly caused by three reasons.

First, location and regional economic development policy is the main driver of spatial pattern of regional economy development [7], and the Zhujiang - Xijiang Economic Belt is forming "one axis, two nuclear, four groups, extension area" of the spatial pattern. As a development strategy for the southwest and central south open support band and the bridgehead of maritime silk road, it plays a connecting southwest central location advantage. For the association of south-east Asian nations (asean) and Hong Kong and Macao, its take a more proactive opening-up strategy, channel and foreign portal construction, which speed up the sea makes a large number of advanced modern technology and management concept to promotion and application, at the same time makes the domestic enterprises to go abroad. The economic pattern of the Zhuhai-Xijiang Economic Belt tends to be integrated, and the division of labor and cooperation among cities in the region become more accurate and effective, thus producing industrial agglomeration effect and easily showing spatial autocorrelation.

Second, with the core of the Zhujiang - Xijiang Economic Belt main comprehensive transportation system is forming. Guangzhou, Foshan, Zhaoqing, Wuzhou, Guigang and Nanning are main port of transportation system. They speed up the port contact industrial concentration area, improved the efficiency of water transportation, and the northern gulf economic zone and formed to promote each other, such as Hong Kong's main port, complementary advantages and common development. The construction of the transport corridor adjacent to the Guangzhou-Guangzhou Railway has constructed the rapid railway network in the southwest region and the Zhujiang region, which has improved the transport capacity of the railway corridor. In addition, the expansion of expressway "guillotine" and feeder airports further speeds up the transportation efficiency and reduces the transportation cost. The integration of the "three networks" unified public information service platform and railway, highway, waterway, airport and other transportation modes promote the industrial agglomeration, transformation and upgrading of the economic belt. It also promotes the spatial autocorrelation between the economy and transportation infrastructure in the region.

In addition, urbanization can effectively promote the highly concentrated population and industries in space, and realize the increasing income effect and economic growth [8]. With Guangzhou and Nanning as the core cities, the Zhujiang - Xijiang Economic Belt will promote the development of surrounding cities and towns into new-type cities and towns with distinctive features. Relying on their own industrial base and the geographical location of traffic arteries, the existing towns are

developing towards traffic nodes and industry and trade respectively. Urbanization has continuously eliminated the gap between urban and rural areas, and promoted the circulation of factors of production.

Therefore, the spatial autocorrelation between the economic growth and the transportation infrastructure in the Zhujiang - Xijiang Economic Belt is mainly due to the excellent regional economic location, the continuous improvement of the comprehensive transportation system and the ongoing urbanization process.

### 3.2 Regression results and analysis

**TABLE IV.** REGRESSION RESULTS OF THE SPATIAL MODEL

Estimation method	Ignore spatial spillover effects	Wk
Wlngdp	-	0.356
Wlntrcap	-	0.0176
Intrcap	0.401	0.296
Inroad	0.087	0.051
lnlabor	0.113	0.068
lnind	0.329	0.029
lngov	0.083	0.044

From the regression results, the transportation infrastructure plays a promoting role in economic growth. The regression coefficients of lnTrcap in the two models were 0.401 and 0.296 respectively, both of which were positive and passed the significance test. The improvement and optimization of transportation infrastructure reduces the cost of capital circulation and speeds up the efficiency of social trade activities, thus promoting the rapid growth of regional economy.

Transportation infrastructure has a positive spatial spillover effect on economic growth, and economic growth itself has a spatial spillover effect. The regression coefficients of the spatial spillover effect of transportation infrastructure (Wlntrcap) and the spatial spillover effect of economic growth (Wlngdp) were 0.0176 and 0.356 respectively, and both passed the significance test. Due to the interconnection of inter-city transportation infrastructure and the development of the city, it has been clear about the function orientation of different cities in the Zhujiang - Xijiang Economic Belt. Guangzhou and Foshan, the metropolitan area, Zhaoqing, the unfertaking industry zone, Liuzhou and Laibin, the transformation zone, Nanning, the open portal area. Every city has its own characteristics of functional areas and lower logistics costs to speed up the regional economic development and fusion among the cities.

Labor force, industrial structure and government input promote economic growth, and their regression coefficients are 0.068, 0.029 and 0.044 respectively, all of which pass the significance test. The increasing number of urban employment promotes the development of urban economy and provides a reserve of talents for urban development. Government expenditure guides and stimulates economic development, and promotes industrial structure transformation, which optimizes economic structure and gradually releases the

development potential of cities in the Zhujiang - Xijiang Economic Belt.

#### **4 CONCLUSIONS AND POLICY RECOMMENDATIONS**

Based on the the Zhujiang - Xijiang Economic Belt's city in 2011-2017 panel data analysis of the relationship between transportation infrastructure and economic growth, according to the results of the Zhujiang - Xijiang Economic Belt, transport infrastructure is spatial spillover effects on economic growth, and the economic growth itself is also spatial spillover effect, and put forward policy Suggestions from the following three directions.

The the Zhujiang - Xijiang Economic Belt should develop in coordination and enhance the level of regional integration. Compared with the eastern cities, the urban development in the central and western part of the economic belt is relatively backward, and the integrated development of the eastern cities is more advanced. The strategy of "Guangzhou is the same city as Foshan" breaks down the administrative barriers between Guangzhou and Foshan, and enable market elements and resources to flow in both directions within the two cities. The total GDP of Guangzhou and Foshan is more than 3 trillion yuan, exceeding that of Beijing and Shanghai. Therefore, cities in western economic belt should further clarify their development orientation and synergetic development. They conduct industrial division according to their own environmental resources and advantageous basis, and develop personalized advantageous industries. The city will work with other cities to promote equal access to basic public services and promote continuous institutional innovation.

Secondly, the comprehensive transportation hub needs to be strengthened. Guangzhou and Nanning are the two core areas of the economic belt, but guangzhou's transportation infrastructure is more complete than Nanning's, and Nanning's railway and subway still have shortcomings. Therefore, it is necessary to accelerate the construction of high-speed railway network with Nanning as the center and the "12310" high-speed railway economic circle. It will accelerate the construction of liuzhou, Wuzhou and other comprehensive regional traffic along the river, so as to enhance the transportation capacity of Nanning traffic nodes and the external support capacity of regional development.

Finally, improve the educational investment mechanism and accelerate the establishment of regional technology innovation system. We will give full play to the strengths of universities in Guangzhou and Nanning, train new and high-tech talents, encourage foreign talents to settle down, support institutions of higher learning in

Guangzhou and other neighboring cities in increasing the number of students they enroll, and provide high-quality educational resources for interconnected regions. We will promote the open sharing of basic scientific and technological resources within the region, build a platform for technological exchange and innovation in cities, cooperate with each other among cities, work together to tackle major scientific research problems, and enhance the scientific research strength of cities in the Pearl River-Xijiang Economic Belt.

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